



**National Aeronautics and Space Administration  
Office of Biological and Physical Research  
Washington, DC 20546**

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# **Research Announcement**

**Research Opportunities  
in  
Space Radiation Biology**

**NASA  
Specialized Centers of Research  
(NSCOR)**

**2003**

**NRA 03-OBPR-02  
March 11, 2003**

**NASA Research Announcement Soliciting Research Proposals for  
the Period Ending June 2, 2003**

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# **Announcement**

## **NASA Specialized Centers of Research for Space Radiation Biology**

### **TABLE OF CONTENTS**

	<u>Page No.</u>
NASA Research Announcement: NASA Specialized Centers of Research for Space Radiation Biology – Summary and Supplemental Information	1
Appendix A: NASA Specialized Centers of Research	A-1
I. Introduction	A-1
II. NSCOR Goals and Objectives	A-2
III. Research Areas of Interest	A-2
IV. Research Elements and Emphases	A-3
A. Description of Research Elements	A-3
B. Solicitation for Project Teams	A-4
C. Structure of the NSCOR	A-9
V. Program Management Information	A-10
A. Type of Award to be Made	A-10
B. Eligibility	A-10
C. Program Reporting/Individual Researcher Reporting	A-11
D. Other Considerations	A-13
VI. The NASA Space Radiation Laboratory (NSRL)	A-14
VII. Other Technical Information	A-15
Appendix B: Application Procedures and Selection Process	B-1
I. Instructions for Proposal Submission	B-1
A. SYS-EYFUS Registration	B-1
B. Instructions for Preparing a Notice of Intent	B-1
C. Instructions for Preparing and Electronically Submitting a Proposal Cover Page	B-2
D. Instructions for Preparation and Delivery of Proposals	B-4

II.	Proposal Evaluation and Awards Selection Process	B-11
	A. Compliance Matrix	B-11
	B. Intrinsic Scientific or Technical Merit Review and Evaluation Criteria	B-11
	C. Evaluation of Programmatic Relevance and Cost	B-12
	D. Development of Selection Recommendation	B-13
III.	Guidelines for International Participation	B-14
IV.	Support of Education and Public Outreach	B-14
V.	References	B-15
	A. General References	B-15
	B. Selected Radiation References	B-16
	C. Selected Workshop Reports	B-17
	D. Selected Radiation Web Sites	B-17
Appendix C:	Certifications	C-1
Appendix D:	Instructions for Responding to NASA Research Announcements	D-1

# **Research Announcement for NASA Specialized Centers of Research in Space Radiation Biology**

## **NRA 03-OBPR-02**

### **Summary and Supplemental Information**

*This National Aeronautics and Space Administration (NASA) Research Announcement (NRA) solicits proposals for NASA Specialized Centers of Research (NSCORs) in support of Space Radiation Research in the Bioastronautics Research and Fundamental Space Biology Divisions of the Office of Biological and Physical Research (OBPR). An NSCOR consists of a team of investigators who have complementary skills and who work together to solve a closely focused set of research questions. The home laboratories of NSCOR team members may be geographically contiguous or dispersed, as long as the NSCOR team members have a mechanism for working together. In the past 10 years, NASA has funded NASA Specialized Centers of Research and Training (NSCORTs) in several areas. The center described in this solicitation will not have an explicit training component and, hence, the abbreviated acronym.*

**The research will be conducted using ground-based irradiation facilities at the NASA Space Radiation Laboratory (NSRL) at Brookhaven National Laboratory (BNL) in Upton, New York. NASA will not fund beam time or other expenses at accelerator facilities other than BNL.** *Proposals outside the stated area of emphasis will be considered non-responsive and will be returned without review. However, NASA reserves the right to act in the best interests of the Federal Government in the matter of acceptance and evaluation of all proposals.*

The mission of the OBPR includes strategic research as its highest priority. Within OBPR, strategic research ([http://spaceresearch.nasa.gov/general\\_info/strat.html](http://spaceresearch.nasa.gov/general_info/strat.html)) includes flight-based and ground-based research that enables NASA's mission to explore the Universe and search for life. The focus of radiation research in OBPR is to use the synergy between biological, physical, and chemical research in space to acquire fundamental knowledge and generate information for space travel and Earth applications. Proposers are strongly encouraged to submit multidisciplinary research proposals consistent with the goals of the OBPR

OBPR programs represent an opportunity for NASA to enhance and broaden public knowledge, understanding, and appreciation of biological and biomedical research, and the value of this research in the space environment. Individuals participating in NASA's OBPR programs have a responsibility to foster the development of a scientifically informed public. Therefore, all participants in this NRA are strongly encouraged to promote general scientific literacy and public understanding of biological and biomedical sciences, the space environment, and OBPR programs through formal and informal education opportunities. Where appropriate, supported investigators will be required to produce, in collaboration with NASA, a plan for communicating their work to the public.

It is anticipated that there will be one award to each of three focused NSCOR research teams dealing with the biological consequences of space radiation on 1) increased risk of leukemia, 2) mechanisms of DNA damage and repair, and 3) the central nervous system. Each award will be funded as a research grant. Selected proposals will be funded in one-year increments for activities lasting up to **five** years. The funding duration will depend on proposal requirements, review panel recommendations, and continuing progress of the activity. All proposals will be evaluated for overall scientific and technical merit by independent peer review panels. The review will also consider the management approach, the integration of the separate projects into the NSCOR, and the likelihood that the total will yield research results that are superior to the results that could be obtained by each project individually. Relevance to NASA's programmatic needs and goals will be evaluated separately by NASA. The government's obligation to make awards is contingent upon the availability of appropriated funds from which payment for award purposes can be made, and the receipt of proposals that the government determines are acceptable for award under this NRA. It is anticipated that a typical award will average **\$1,500,000** per year (total annual cost). The total annual cost for a single ground research grant shall not exceed **\$2,000,000** per year. NASA reserves the right to return proposals, without review, that exceed the described award amounts. NASA does not provide separate funding for direct and indirect costs; thus, the amount of the award requested is the total of all costs submitted in the proposed budget. It is estimated that initial selections will be announced by **August 2003** and grants awarded shortly thereafter. However, selection of one or more NSCORs and start of funding may be delayed to the start of the next fiscal year.

**This research will utilize beams of high-energy heavy nuclei delivered to the NASA Space Radiation Laboratory (NSRL), by the Brookhaven National Laboratory (BNL) Booster Synchrotron as well as higher energy beams from the Alternating Gradient Synchrotron (AGS).** These beams simulate the high-energy, high-charge (HZE) components of galactic cosmic rays that constitute the biologically most significant component of space radiation. NSRL is a new \$34 million irradiation facility at BNL, funded by NASA, and is expected to start delivering beams for experiments in fall/winter of 2003.

Proposals for this NRA are due at 4:30 p.m. Eastern time on June 2, 2003. Proposals shall not be submitted electronically, except for parts specified in this NRA. Proposals mailed through the U.S. Postal Service by express, first class, registered, or certified mail are to be sent to the following address:

NASA Peer Review Services  
SUBJECT: 03-OBPR-02 Space Radiation Research NSCOR  
500 E Street SW  
Suite 200  
Washington, DC 20024

Proposals that are hand delivered or sent by commercial delivery or courier services are to be delivered to the above address between 8:00 a.m. and 4:30 p.m. Proposals must be received by 4:30 p.m. Eastern time on the proposal due date. The telephone number, (202) 479-9030, may be used when required for reference by delivery services. NASA Peer Review Services (NPRS) cannot receive deliveries on Saturdays, Sundays, or federal holidays. NPRS will send

notification to the investigator confirming proposal receipt within 5 business days of the proposal receipt date; however, there will not be a response from the Office of Biological and Physical Research.

The following items apply only to this Announcement:

<b>Solicitation Announcement Identifier:</b>	<b>NRA 03-OBPR-02</b>
<b>Number of Copies Required:</b>	<b>Original + 20 copies</b>
<b>Proposals Due:</b>	<b>June 2, 2003</b>
<b>Estimated Selection Announcement:</b>	<b>August 2003</b>
<b>Selecting Officials:</b>	<b>Directors, Bioastronautics Research Division Fundamental Space Biology Division Office of Biological and Physical Research</b>

Safety is NASA's highest priority. Safety is the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property, or damage to the environment. NASA's safety priority is to protect: (1) the public, (2) astronauts and pilots, (3) the NASA workforce (including employees working under NASA instruments), and (4) high-value equipment and property. All research conducted under NASA auspices shall conform to this philosophy.

This NRA is organized such that

- Appendix A provides a detailed description of the research areas solicited by this Announcement.
- Appendix B contains specific instructions for this NRA and selection process information.
- Appendix C contains copies of the certifications required with any signed application.
- Appendix D provides reference instructions for responding to NASA Research Announcements.

Participation in this Announcement is open to all categories of organizations, industry, educational institutions, other nonprofit organizations, NASA laboratories, and other government agencies. Guidelines for International Participation are detailed in Appendix B, Section IV, of this Announcement.

Additional technical information is available from

David L. Tomko, Ph.D.  
NASA Headquarters, Code UB  
Washington, DC 20546-0001  
Telephone: (202) 358-2211  
Fax: (202) 358-4168  
E-mail: dtomko@hq.nasa.gov

The contracting point of contact will be specified in each selection notification letter.

This Announcement is restricted to the program named above and described in detail in Appendix A. Potential investigators should read with care the program descriptions that are of interest and focus their proposals on the specific research emphases defined in this Announcement.

Your interest and cooperation in participating in this effort is appreciated.

Original signed by

Mary E. Kicza  
Associate Administrator  
Office of Biological and Physical Research

**National Aeronautics and Space Administration  
Specialized Centers of Research (NSCOR)**

**I. Introduction**

The ultimate goal of NASA's Space radiation research within OBPR is to acquire the scientific knowledge that will enable the human exploration of space without exceeding limiting risks from space radiation. Space radiation is distinct from common terrestrial forms of radiation because it is comprised of high-energy protons and heavy ions and their secondaries produced in shielding and tissue. Since there are no human epidemiological data for these radiation types, risk estimation must be derived from a mechanistic understanding based on radiation physics, and from molecular, cellular, tissue, and organismal radiation biology related to cancer and other risks of concern to NASA. Research to be supported will seek to reduce the uncertainties in risk predictions for leukemia and presumed effects on the central nervous system (CNS), and to significantly advance the understanding of the mechanisms of DNA damage processing that underlies radiation effects in general. The results of this research are essential to provide the scientific basis for eventual development of biological countermeasures to these risks in humans.

It is NASA's intention that NSCOR teams include biologists who will use cutting-edge scientific tools and methods to answer critical research questions regarding the consequences of space radiation to biological systems. Scientists working in rapidly developing areas of life sciences not necessarily associated with the study of radiation are particularly encouraged to consider the contributions that their field of study can make, and to propose relevant investigations. However, investigators new to radiation research are encouraged to consult or collaborate with radiation experts in order to develop realistic experimental plans. The background information in this Appendix and the list of references are intended to provide a useful starting point for such scientists as well as for expert radiation researchers not necessarily familiar with the idiosyncrasies of space radiation. Furthermore, NASA scientists are available to assist investigators wishing to enter this field of research.

The purpose of this Appendix is to describe the rationale and objectives of the NSCOR program, the types of awards to be made, and the research focus of this solicitation. **This NRA does not request proposals for flight research.** It is important that prospective investigators read the relevant section(s) carefully, as some of the programmatic emphases are different from those appearing in previous OBPR Announcements. In addition, this NRA includes guidelines for preparing and submitting proposals and defines the administrative policies governing the program and investigators.



## II. NSCOR Goals and Objectives

The NSCOR program was established to advance fundamental knowledge in biological and biomedical sciences and technology, with the ultimate application of this knowledge to enable human space flight and long-term planetary missions. The NSCOR program is expected to enhance NASA's base of scholarship, skills, and performance in the space biological and biomedical sciences and related technological areas, and also expand the pool of research scientists and engineers trained to meet the challenges ahead as we prepare for future human space exploration missions.

**An NSCOR differs from a set of independent projects in that suitable mechanisms are defined to engage the contributing projects in a synergistic manner, so that the total output of the NSCOR is greater than the sum of the parts: each project needs to contribute to all other projects, and each project needs to benefit in demonstrable ways from the contributions of all other projects. The team approach is also expected to lead to experimental protocols that achieve efficient beam utilization and sharing of experimental resources.**

General goals of the NSCOR program are

- to expand our understanding of specific scientific and technical challenges associated with biological and biomedical sciences;
- to provide substantial long-term funding to the research community in a manner that encourages the development of a stable base upon which problem-solving strategies can be built for the benefit of NASA and the public;
- to involve a broad spectrum of high caliber students, research scientists, and engineers in the activities of the NSCOR; and
- to facilitate the rapid transfer to NASA of knowledge gained and technology developed that is consistent with its missions.

The management structure must be the minimum that is consistent with financial and programmatic accountability and should not impose onerous costs or procedures on the investigators. Procedures to allocate resources and adjudicate differences of opinion need to be clearly defined and agreed upon by all participants.

## III. Research Areas of Interest

**Research proposals are expected to utilize beams of charged particles available at the NSRL or at the Alternating Gradient Synchrotron (AGS), and to address experimental data obtained with such beams in ways leading to significant predictions that can be tested in future experiments.** Detailed information about the NSRL may be found in Section VI of

this Appendix. Initial operation of the NSRL is expected before the end of FY 2003. In FY 2004 and subsequent years, the emphasis will be on utilization of Booster Synchrotron beams; AGS beams will continue to be available, but scientific justification for the use of their higher energies will need to be provided. NASA intends to operate these facilities for 600 hours or more per year if funds are available; selection of beam species and beam energies for experimental periods will be made by program managers in consultation with scientists proposing experiments for these beams. Investigators selected for funding will need to meet BNL requirements for experiment scheduling in order to gain access to beams and irradiation facilities.

NASA negotiates beam delivery directly with BNL, and investigators proposing to use these irradiation facilities should not include the cost of beam time in their budgets. However, investigators should include the cost of carrying out the experiments, including travel to BNL, and provide an estimate of the hours of beam time required to conduct their experiments.

## **IV. Research Elements and Emphases**

### **A. Description of Research Elements**

**To be responsive to this research solicitation, proposed studies should be hypothesis-driven and lead to new knowledge within accepted scientific standards. Purely phenomenological approaches with no significant mechanistic basis or likely gain in scientific knowledge are not acceptable. Experimental studies not directly using the irradiation facilities at BNL or not directly relevant to improved interpretation of experiments already conducted with such radiation will not be funded.**

Each proposal should identify a coordinating Principal Investigator (Director) who will be responsible for ensuring that the NSCOR includes investigators with appropriate expertise in radiation biology. Experimental protocols should reflect a careful consideration of irradiation requirements, including justified estimates of dose, dose rates, and beam time for selected examples. Proposals should take into account the impact of gender, age, nutrition, stress, genetic predisposition, or sensitivity to other factors of importance in managing space radiation risks.

**Proposals must identify questions and priorities enumerated in the Critical Path Roadmap (CPR) that will be addressed by or answered by their proposed research.** Information about the CPR can be found online at <http://criticalpath.jsc.nasa.gov/main.asp>.

The focus and intended outcome of radiation biology research results is to provide scientific understanding that will be used to develop means and methods to assure the safety and vitality of astronaut crews via the development of accurate risk projections and countermeasures based on a thorough understanding of fundamental radiobiology.

## B. Solicitation for Project Teams

There are three areas for which project teams are solicited: (1) a cancer effects project with emphasis on leukemia; (2) a cellular and molecular biology project with emphasis on understanding the mechanisms of damage processing by DNA; and (3) a project addressing issues of neuronal risk from space radiation, with emphasis on CNS effects. The primary criterion for an award will be scientific merit. Proposers are encouraged to establish interdisciplinary teams that address the objectives outlined below. However, proposers are not required to cover the entire discipline area solicited, but only that part of the solicited research that best matches the NSCOR criteria with the investigators' expertise.

### **NSCOR 1. Cancer Effects**

This project team would consider biological models for understanding the risk of leukemias. However, studies that consider leukemias along with other cancer sites are encouraged. Human epidemiological data following low-LET irradiation indicates that leukemias (acute myeloid leukemia (AML), chronic myeloid leukemia (CML), acute lymphocytic leukemia (ALL)) have the highest relative risks of all radiation induced cancers, a significant absolute risk, and are the earliest appearing cancers following radiation exposure with a latency period as short as one year post irradiation. The latency period following high-LET radiation is observed to be shorter than that of low-LET radiation in animal studies of leukemias, mammary, lung, and other cancers, and is a concern for risk assessment. The average time to tumor appearance is also shortened in animal models that show increased radiation sensitivity due to inactivation of genes involved in repair of DNA damage, cell cycle checkpoints, and other genes. This NSCOR team should focus their research on one or more of the following topical questions:

- a. How can risk estimates for protons and HZE particles best be made using animal models of leukemia or other cancers, including transgenic models of human cancers?
- b. Are there molecular biomarkers of cancer initiation (chromosomal changes leading to fusion genes (transcription factors), genomic instability, hyper-methylation, etc.), or other cellular and molecular changes caused by protons and HZEs?
- c. What are the biological factors that contribute to latency as a function of cancer type, age, radiation quality, and individual sensitivity, and how can they be used to improve risk assessment models?
- d. What is the role, if any, of space flight factors such as immune depression on leukemia initiation processes?
- e. How can the discovery of biological countermeasures to leukemia or other cancers, including targeting fusion genes and other molecular targets for apoptosis or differentiation, best be achieved?

## NSCOR 2. Mechanisms of Radiation Damage and Repair

This NSCOR team will focus on the cellular and molecular effects of irradiation with HZE particles and/or energetic protons typical of the space flight environment. Emphasis should be placed on developing a basic understanding of the mechanisms of DNA damage and repair including signal transduction, gene expression, apoptotic pathways, and other mechanisms involved in cell cycle control, and cell/cell and cell/tissue interactions. The selected NSCOR team should include leaders in the fields of radiobiology, cell biology, molecular biology, genetics, immunology, and cancer biology. Comparative studies with different radiation types and exposures (dose and dose rate) should be conducted on a representative range of cell types and species, and address the applicability of selected models to effects on humans. Studies examining effects in the context of local cellular environments (*i.e.*, biological matrices and mixed cell types) are also encouraged. Cellular and molecular research involving the central nervous system should be addressed by responding to NSCOR 3, described below. The following areas of research and critical questions pertinent to NSCOR 2 are provided as research examples of particular interest to NASA at the present time:

- a. *Mechanisms of molecular damage.* Studies examining the mechanisms, nature, and frequency of DNA damaging events are of interest. The induction of DNA single- and double-strand breaks as well as other potentially mutagenic or carcinogenic changes should be studied. Other potential targets of radiation damage (*e.g.*, cell membrane or mitochondrial damage) are also of interest.
- b. *Molecular repair of damage.* How does a cell cope with radiation-induced damage? Molecular studies of cellular damage processing, including mechanisms of DNA repair and misrepair, are of particular interest. Signal transduction mechanisms are also of interest. Studies examining the effects of hypergravity (centrifugation) and/or simulated microgravity (rotating wall vessels) on damage processing are also encouraged.
- c. *Alterations in gene expression.* Genomic expression surveys and analyses of altered protein structure and function are desired. Both immediate and long-term, and reversible and irreversible changes should be examined. Focus should commence on an understanding of gene products known to be important in stress responses and proliferation.
- d. *Induction of apoptosis/cell death.* How does irradiation with HZE/protons result in cell death? What are the mechanisms and thresholds for the induction of apoptosis and necrotic cell death?
- e. *Bystander effects.* It has been noted in various studies that irradiation of a single cell (or a small group of cells) in a confluent culture can lead to “bystander effects,” including the induction of apoptosis, in neighboring cells. Proposals are sought that examine the extent and nature of these “bystander effects,” including mechanisms of cell-cell communication. Studies examining these effects in mixed cell cultures are encouraged.

- f. *Tissue remodeling.* One possible mechanism for “bystander effects” is cellular remodeling of the extracellular matrix and tissue reorganization. These are also potential mechanisms of “repair” at the tissue level as new cells are recruited to replace dead cells, preserving tissue function. Those studies examining tissue and matrix effects are of interest.
- g. *Mechanisms of tumorigenesis.* Cellular and molecular studies on the mechanisms of HZE/proton induced transformation and progression to a tumorigenic/metastatic phenotype are solicited. Studies on the effects of immunosuppression on tumor induction and progression will also be considered.
- h. *Mechanisms of mutagenesis.* The heritable effects of HZE/protons are of great interest. Studies examining DNA damage have been described above. In addition, those focusing on examining alterations in chromatin structure and organization; rates of homologous and non-homologous meiotic recombination, including translocations; and any other methods of exchange of genetic material are relevant. Studies examining mechanisms of genomic instability are also encouraged.
- i. *Cross species comparisons.* We wish to emphasize that the ultimate goal of the proposed research is to generate sufficient fundamental biological knowledge to enable NASA to guarantee the safety and well-being of astronaut crews. It is therefore critical that study results be relevant to our understanding of human radiation responses. Efforts should be made to relate research results to expected results in humans by engaging in comparative studies utilizing appropriate model systems.

### **NSCOR 3. Neuronal Risks from Space Radiation**

Two sources of space radiation are of potential concern for radiation health risks to the central nervous system (CNS): exposure to HZE particles in deep space and unplanned exposure to a large solar particle event. The exposure to HZE particles is of concern because of their unique pattern of energy deposition; large solar particle events are of concern because they may deliver relatively high dose and dose rates. This NSCOR team should consider animal models and human radiation oncology studies for understanding and mitigating acute performance effects and possible late degenerative effects to the CNS from space radiation, including individual based risk assessments. A Space Radiation Health Project Workshop sponsored by NASA in December of 2000, “Neuroscience and Radiation Biology,” has identified a large number of critical research questions that should be considered to address CNS risk prediction and mitigation (proceedings found online at <http://srhp.jsc.nasa.gov/Newsletter/Volume1-3/CNS/CNS-PPT.htm>).

NSCOR proposals in this area of research are expected to utilize insights in molecular and cellular mechanisms (see below) in conjunction with *in vivo* models of neuronal risk to develop translational approaches at the biological systems level. The selected NSCOR team should include leaders in the fields of radiobiology, cell biology, molecular biology, genetics, and neurobiology. Comparative studies with different radiation types and exposures (dose and dose rate) should be conducted on a representative range of species and CNS cell types, and address

the applicability of selected models to effects on humans. Studies examining effects in the context of local cellular environments (*i.e.*, biological matrices and mixed cell types) are also encouraged, and could include whole animal studies.

The cellular and molecular effects of irradiation with HZE particles and/or energetic protons typical of the space flight environment on the mammalian central nervous system that are of interest include

- a. *Mechanisms of molecular damage.* Studies examining the mechanisms, nature, and frequency of DNA damaging events are of interest. The induction of DNA single- and double-strand breaks, as well as other potentially permanent genotypic changes (somatic mutations) should be studied. Other potential targets of radiation damage (e.g., cell membrane or mitochondrial damage) are also of great interest.
- b. *Molecular repair of damage.* How does the CNS cope with radiation-induced damage? Molecular studies of damage processing and repair, including mechanisms of DNA double-strand break repair, are of particular interest. Signal transduction mechanisms are also of interest. Studies examining the repair of other types of damage, including non-genetic damage, will also be considered. Studies examining the effects of hypergravity (centrifugation) and/or simulated microgravity (rotating wall vessels) on damage repair are encouraged.
- c. *Alterations in gene expression.* Genomic expression surveys and analyses of altered protein structure and function are desired. Both immediate and long-term and reversible and irreversible changes should be examined. Focus should commence on an understanding of gene products known to be important in stress responses and proliferation.
- d. *Induction of apoptosis/cell death.* How does irradiation with HZE/protons result in cell death? What are the mechanisms and thresholds for the induction of apoptosis and necrotic cell death?
- e. *Bystander effects.* It has been noted in various studies that irradiation of a single cell (or a small group of cells) in a confluent culture can lead to “bystander effects,” including the induction of apoptosis, in neighboring cells. Proposals are sought that examine the extent and nature of these “bystander effects,” including mechanisms of cell-cell communication. Studies examining these effects in mixed cell cultures are encouraged.
- f. *Tissue remodeling.* One possible mechanism for “bystander effects” is cellular remodeling of the extracellular matrix and tissue reorganization. These are also potential mechanisms of “repair” at the tissue level as new cells are recruited to replace dead cells, preserving tissue function. Those studies examining tissue and matrix effects are of interest.
- g. *Cytokine activation and inflammation.* Microglia are thought to function as the primary immune cells of the CNS. Studies examining cytokine production and activation

following radiation exposure are of interest. Characterization of inflammatory responses including the type and function of responding cells, the relationship of the inflammatory response to the initial radiation damage, and beneficial vs. non-adaptive immune responses are also of interest. Cytokine production may be a mechanism for observed “bystander effects” (see above).

- h. *Mechanisms of somatic mutagenesis.* Permanent phenotypic effects (somatic mutations) of HZE/protons on the CNS are of great interest. Studies examining DNA damage have been described above; in addition, those focusing on examining alterations in chromatin structure and organization are relevant. Studies of somatic mutations and their expression in neuronal cells, in particular, inactivation of molecules by mutation or other processes that have been implicated in the pathogenesis of late degenerative CNS risks (e.g. apoE, tau, amyloid beta), are of particular interest.
- i. *Mechanisms of Neuropharmacological Damage:* Modulation of dopamine activity and related pharmacological changes have been indicated in behavioral changes observed following HZE irradiation in animal models. Acute and chronic oxidative stresses are likely inducers of such changes; however, the basic mechanisms are not completely understood. Studies that improve the basic knowledge of these processes and their modulation by space radiation are highly encouraged.
- j. *Cross species comparisons.* We wish to emphasize that the ultimate goal of the proposed research is to generate sufficient fundamental biological knowledge to enable NASA to guarantee the safety and well-being of astronaut crews. It is therefore critical that study results be relevant to our understanding of human radiation responses. Efforts should be made to relate research results to expected results in humans by engaging in comparative studies utilizing appropriate model systems.

At the organism level, the following focused research questions are provided to indicate examples of areas of particular interest to NASA:

- a. How can animal models of acute CNS risks, including altered motor and cognitive function and behavioral changes, be used to estimate space radiation risks to astronauts?
- b. How can animal models of late degenerative risks, including loss of neurons, altered morphology, role of neuronal and non-neuronal cells, integrated cellular responses, and the vasculature, be best used to estimate potential risks to astronauts?
- c. Are there human data from radiation oncology results that can be utilized to estimate CNS risks from space radiation, such as assessing the loss of cognition and reduced performance, latency time, etc?
- d. What is the role of individual susceptibility to CNS risks including hereditary predisposition (Alzheimer’s, Parkinson’s, apoE) and prior CNS injury (concussion or other)?

- e. How can cellular and molecular models be used in conjunction with animal and human data to best determine acute or late CNS risks from space radiation?

## C. Structure of the NSCOR

### **Interactions among Investigators, University Partners and NASA**

Teaming arrangements among investigators and research groups at the same institution and between different institutions is required and must be clearly explained. Evidence of appropriate institutional approval from each institution must be included in the proposal. The sharing of resources and responsibilities between member institution(s) must be explicitly stated in the proposal.

### **Key Personnel**

Each proposing team must have a coordinating Principal Investigator with demonstrated scientific and administrative leadership qualities who will serve as NSCOR Director. The proposal should contain a detailed and coherent management structure that is conducive to accomplishing the goals of the NSCOR and is consistent with the research goals of the space radiation research program. The positions of NSCOR Director, Associate Director(s) (if any), and Research Leads (Principal Investigators) are considered Key Personnel. Their qualifications, roles, and responsibilities must be clearly defined in the proposal and they may not be substituted or removed without NASA's approval. The expertise of the key personnel should match the areas of emphasis. The Director of the NSCOR will be considered as the primary point of contact between the NSCOR and NASA. A written agreement with the proposal and a commitment to carry out their responsibilities in the event that the NSCOR is selected and funded must be signed by each participating Principal Investigator.

### **Scientific Advisory Committee**

Each NSCOR proposal must identify a plan to establish an NSCOR Scientific Advisory Committee to assist and support the Director to ensure that

- the internal activities and external interactions of the NSCOR are coordinated;
- funds are allocated and used to properly fulfill the objectives of the NSCOR;
- fair procedures are in place to adjudicate differences of opinion among the participants;
- advice on productivity and effectiveness of the NSCOR is provided to the Director; and
- appropriate interactions take place to assure information exchange and technology transfer among scientists, engineers, and administrators, and those in other public and private institutions deemed important to the effort.



The NSCOR Scientific Advisory Committee should include members with appropriate scientific and management expertise from all of the participating institutions. The composition of this committee is at the discretion of the Director, but it must meet formally, at least yearly, to evaluate the NSCOR's progress.

### **Expertise of Universities**

#### *Academic Departments*

The different academic departments at the participating institutions must have committed personnel and facilities to accommodate the research needs of this NSCOR. There should be a plan for coordination of research activities and resource sharing.

#### *Personnel*

The participating institutions must have faculty with the expertise to undertake this multidisciplinary NSCOR project. The proposal should outline how the complementary expertise of the faculty will result in a teaming effort that will adequately address the research needs of the NSCOR.

### **Roles and Responsibilities**

In order to achieve the research goals of the NSCOR, the roles and responsibilities of the individual investigators, Research Leads, Associate Director(s), and the Director must be clearly defined. The proposal must also include a description of these roles and responsibilities and interactions between partnering institutions. A description of the process for the transfer of resources and other partnering agreements between the participating institutions must be included in the proposal.

## **V. Program Management Information**

### **A. Type of Award to be Made**

The mechanism for funding the NSCOR will be a single grant for each NSCOR, with funding allocations to participating investigators based on the submitted budget. The NSCOR Director, with the advice and consent of the internal advisory committee, may make changes in this budget. The NSCOR will be funded by NASA one year at a time. The funding is to last for a maximum of five years, and the total of indirect and direct costs may not exceed \$2.0 million/year. The NSCOR Director is expected to work closely with the appropriate technical representatives from NASA in order to assure continued success and programmatic relevance. NASA will conduct a yearly review of NSCOR progress, as described below.

### **B. Eligibility**

All categories of U.S. institutions are eligible to submit proposals in response to this NRA. Principal Investigators may collaborate with universities, Federal Government laboratories, the

private sector, and state and local government laboratories. In all such arrangements, the applying entity is expected to be responsible for administering the project according to the management approach presented in the proposal.

The applying entity must have in place a documented base of ongoing high quality research in science and technology, or in those areas of science and engineering clearly relevant to the specific programmatic objectives and research emphases indicated in this Announcement. Present or prior NASA support of research or training in any institution or for any investigator is not a prerequisite to submission of a proposal or a competing factor in the selection process.

### C. Program Reporting/Individual Researcher Reporting

The proposal must indicate how the NSCOR will maintain awareness of NASA's needs in the technical areas described in this Announcement and maintain communication with the appropriate points of contact at NASA, which are listed in Section III of this Appendix.

As a vital measure of productivity, results from NSCOR research should be submitted to peer-reviewed journals as the work progresses. Only those published papers that acknowledge NASA's support and identify the NSCOR grant as a funding source will be counted as resulting from the NSCOR and used to evaluate its productivity.

The Director, project leaders, and other members of the team (by agreement with NASA management) shall attend an annual review at a location specified by NASA, where they shall present an overview of their progress, and discuss appropriate revisions to the NSCOR plans.

The Director, project leaders, and participating investigators shall present current results of their research at the Annual Space Radiation Health Investigators' Workshop.

#### **NSCOR Annual Report**

The Director shall provide an annual written report to NASA on or before the anniversary of the start of funding that details progress including a list of publications and personnel actions. This information will consist primarily of

- an abstract;
- a bibliographic list of publications;
- copies of publications; and
- a description of progress, including a comparison with the originally proposed work schedule.

The yearly report must include information for each research project undertaken by the NSCOR. Additionally, the annual report must also include the following information for the entire NSCOR (encompassing all projects):

- a report on interactions and collaborations with groups outside the NSCOR;

- a plan for the next 12 months; and
- status information on the NSCOR's management and financial condition, projects (completed and in-progress), personnel changes and partnerships.

This information will be made available to the scientific community and will be used to assess the strength of the OBPR programs. It will also serve as the basis for determining the degree of progress of the NSCOR.

### **Individual Researcher Annual Task Book Reporting**

The OBPR Tasks and Bibliography (OBPR Task Book) is published annually by the OBPR. The Task Book includes descriptions of all peer-reviewed activities funded by the OBPR during the previous fiscal year. The Task Book is an invaluable source of information for NASA biological and biomedical researchers as well as the external scientific and technical communities. In addition to the annual program reporting by the NSCOR, all individual Research Leads are required to submit an annual report for inclusion in the OBPR Task Book.

The NSCOR Research Leads (Principal Investigators) must provide information for this publication on an annual basis. Please note that this requirement is in addition to the annual report, which the NSCOR is required to submit at the end of each funding cycle. Supplying the requested information for the OBPR Task Book does NOT fulfill the requirement for the annual report. The information should be concise and should be written at a level adequate for understanding by educated laypersons.

The information that must be included in the report for the Task Book consists primarily of

- an abstract;
- a brief statement of progress during the fiscal year;
- a brief statement of benefits of the research with respect to life on Earth;
- a bibliographic list for the fiscal year;
- a copy or reprint of each publication listed in the bibliography for the fiscal year; and
- a listing of interactions, presentations, or other activities with the general public.

Please note that each individual research project undertaken at the NSCOR needs to comply with the Task Book requirement. Also note that although this publication will be made available to the general scientific community, it is not a substitute for traditional scientific reporting, in journals and elsewhere.

### **Annual Investigators' Meeting**

All scientific participants in the NSCOR are required to attend the Annual Space Radiation Health Investigators' Workshop. This includes the Director, the Principal Investigators, the participating researchers, and especially postdoctoral fellows and graduate students. These meetings are generally held in spring or summer and often have international participation. No

proceedings are published, in order to encourage informal exchanges of information between scientists.

### **Annual NASA Review**

The Director, project leaders, and selected members of the team (by agreement with NASA management) shall attend an annual review (at a location specified by NASA, either Washington DC or an appropriate NASA Center) where they shall present an overview of their progress, and discuss appropriate revisions to the NSCOR plans with NASA management. Selected members of the original merit review panel and additional scientific experts may be invited to participate in the evaluation of scientific progress. This review is intended to be both scientific and programmatic, and to provide a frank exchange of opinions without the constraints of public presentations at a formal meeting or workshop. Its purpose is to enable NASA and the participating scientists to arrive at a clear assessment of progress and to facilitate the adoption of new approaches where these might be productive.

### **Final Report**

A final report must be provided to the appropriate Division Director at NASA HQ at the end of the five-year funding period, including a detailed listing of all peer-reviewed publications. Information required for inclusion in final reports is

- summary of the NSCOR research activities;
- statement of the specific objectives;
- significance of the work;
- background;
- overall progress during the performance period;
- narrative discussion of technical approaches including problems encountered;
- accomplishments related to approach; and
- an appendix with bibliography and copies of all publications and reports. Any publications or other public materials containing data are particularly important to include in this section.

## **D. Other Considerations**

### **Required Travel**

The proposal must include travel funds for the following:

- Experiments to be performed at BNL
- Annual Investigators meeting
- Annual NASA review: Optional Travel
- Visits to NASA Field Centers
- Presentation at a professional society meeting (highly desirable)

## **VI. The NASA Space Radiation Laboratory (NSRL)**

NASA has signed Memoranda of Agreement (MOA) with the Department of Energy (DOE) and with Brookhaven National Laboratory (BNL) to utilize the Alternating Gradient Synchrotron (AGS) (beams of iron and other heavy nuclei, with energies as low as 600 MeV/nucleon, up to 10 GeV/nucleon) and to build and operate a new facility, the NASA Space Radiation Laboratory (NSRL), currently under construction. The AGS machine is a U.S. Department of Energy (DOE) facility that is funded by the DOE primarily for research in high-energy particle and nuclear physics. The DOE allows Brookhaven to provide additional AGS beam time to other scientific users of the machine, as long as operating funds are provided by the sponsor of such proposed work. Delivery of beam time is directly funded by a contract between NASA and Brookhaven.

Use of the Brookhaven facilities requires a separate application, which is reviewed by a laboratory-appointed panel and is scheduled in accordance with available beam time and other laboratory resources. Once experiments are approved, they are required to satisfy the normal process of preparation for running at the AGS, which includes familiarization with AGS rules and policies (safety being the paramount consideration among these) and registration with the laboratory as a guest scientist. Applications for beam time are required to provide realistic experimental protocols, using appropriate estimates of irradiation times, numbers of samples, and choice of irradiation parameters.

User facilities have been developed at Brookhaven for radiation biology research, including cell cultures and small animals. These include the shielding cave containing the beam, the biological experiment station, and laboratory space and animal facilities in the Brookhaven Medical Department. A 10-foot-long optical bench for sample exposures is available in the cave, as well as beam handling, sample changing, and dosimetry instrumentation. The biological experiment station contains one area for cell culture equipped with a laminar flow hood and incubator, one short-term animal holding facility, and one area for physics/run-control use. In addition, laboratory space and access to animal facilities accredited by the Association for Assessment and Accreditation of Laboratory Animal Care are available in the Medical Department, subject to standard use charges. Brookhaven also has on-site housing accommodation for users (dormitory and apartment-style units).

Iron ( $^{56}\text{Fe}$ ) beams at 600 MeV/nucleon and at 1 GeV/nucleon, as well as  $^{28}\text{Si}$  and  $^{79}\text{Au}$ , have been used for experiments to date. A full set of beams and energies required to accomplish the radiation program objectives continues to be developed with input from the science community and Brookhaven experts. Information on beams and energies used in previous experiments is available from the Brookhaven liaison scientists listed below and from the Bibliography.

Normally, circular beam spots are provided, with diameters up to 10 cm and center-to-edge uniformity between 10 and 20 percent (depending on dose rate—high dose rate beams are less uniform than low-dose rate beams). Dose rates have been measured up to 11 Gy/min. Investigators currently funded by the NASA program participate in research using these beams; coordination of beam use with these investigators and institutions is actively encouraged. In particular, a physics and dosimetry group is available for investigators requiring their assistance.

The NASA Space Radiation Laboratory (NSRL) is an irradiation facility based on BNL Booster Synchrotron beams—ions from protons to gold in the energy range of 40-3000 MeV/nucleon. This synchrotron is placed between the Van de Graaff injectors and the higher energy AGS. The NSRL is a joint effort of the collider-accelerator department, providing accelerated ion beams; the BNL Biology department, providing experimental area support; and the Medical department, which provides animal care facilities and cell laboratories. It is expected to become operational in fall of 2003. The NSRL includes irradiation stations, beam controls, and laboratory facilities required for most radiobiological investigations.

For further information regarding Brookhaven National Laboratory, contact Dr. Marcelo Vazquez (e-mail: [vazquez@bnl.gov](mailto:vazquez@bnl.gov)), Dr. Betsy Sutherland (e-mail: [betsy@image.bio.bnl.gov](mailto:betsy@image.bio.bnl.gov)), or Dr. Phil Pile (e-mail: [pile@bnldag.ags.bnl.gov](mailto:pile@bnldag.ags.bnl.gov)). The address is Brookhaven National Laboratory, PO Box 5000, Upton, NY 11973-5000. Information about this facility is also available online at [http://bnlstb.bio.bnl.gov/biodocs/nasa/nasa\\_ags.htmlx](http://bnlstb.bio.bnl.gov/biodocs/nasa/nasa_ags.htmlx).

Consult the following Web site for instructions on how to incorporate the use of these facilities into a proposal: [http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-02/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-02/index.html). These instructions must be followed in order to access the facilities.

## **VII. Other Technical Information**

For additional information about NASA and its mission and goals, please visit <http://www.nasa.gov/>. For additional information about the Office of Biological and Physical Research, please visit <http://spaceresearch.nasa.gov/>.

## **Application Procedures and Selection Process**

Except where specifically stated otherwise in this NRA, applicants must prepare proposals in accordance with the “Instructions for Responding to NASA Research Announcements,” which is part of the NASA Federal Acquisition Regulations (FAR) Supplement (NFS), Part 1852.235-72 (APPENDIX D).

### **I. Instructions for Proposal Submission**

#### **A. SYS-EYFUS Registration**

SYS-EYFUS is an electronic system used by NASA Headquarters to manage research solicitation activity, plan for the receipt of research proposals, track the receipt and peer evaluation of these proposals, and manage funded research (grants, cooperative agreements, etc.) sponsored by NASA’s Office of Equal Opportunity (Code E), Office of Earth Science (Code Y), Office of Human Resources & Education Division (Code F), Office of Biological and Physical Research (Code U), Office of Space Science (Code S), and the Office of Space Flight (Code M). SYS-EYFUS also supports the funding and administration of awards pursuant to selection of these research opportunities.

The SYS-EYFUS Help Desk is available at (202) 479-9376. Help desk hours are from 8 a.m. to 6 p.m. Eastern time.

All investigators planning to submit a proposal to this solicitation are requested to register online with SYS-EYFUS. Comprehensive help, instructions, and contact information are provided online. SYS-EYFUS can be accessed at the following Web address:

**<http://proposals.hq.nasa.gov/proposal.cfm>**

If you have previously registered with SYS-EYFUS, you are asked to verify and update your user information. If you have forgotten your user ID or password, select the “Forgot Your Password” option and type in your first and last name to search our database. The system will send an automatic e-mail message with your username and password to the e-mail address listed in our database.

#### **B. Instructions for Preparing a Notice of Intent**

Notices of Intent (NOI) are not requested before submission of proposals responding to the present solicitation.

## C. Instructions for Preparing and Electronically Submitting a Proposal Cover Page

All investigators planning to submit a proposal in response to this solicitation must electronically submit proposal cover page information online and provide a hardcopy of the cover page attached to each proposal copy by the due date indicated in the Summary and Supplemental Information Section of this NRA. The proposal cover page can be submitted and printed via the Web at the following address:

<http://proposals.hq.nasa.gov/proposal.cfm>

- 1) Login to SYS-EYFUS at the URL listed above.
- 2) To submit a New Proposal Cover Page, click the “New Proposal Cover Page” option on the SYS-EYFUS Options screen, and the New Proposals Cover Page screen will appear.
- 3) Click on New Proposal Cover Page option, and the Division Specific Opportunities screen will appear.
- 4) In the selection window, highlight **Bioastronautics Research Division** and click on “Continue” (please note proposals will be reviewed by the appropriate OBPR division and selecting the Bioastronautics Research Division is only for record keeping).
- 5) The List of Existing Opportunities screen will appear. In the selection window, highlight **03-OBPR-02** and then click on “Continue.”
- 6) This will bring you to the Proposal Cover Page Submission Form. Fill in all the fields. All fields are required.
  - a. Please select from **only** the following three options: For the proposal type field on this form, new / no prior support means that the investigator has not received NASA funding from 2000 through 2002, new / prior support means that the investigator has received NASA funding between 2000 through 2002, and revised means that the proposal is a revised version of a proposal submitted to NASA and reviewed from 2001 through 2002, but not funded. A proposal previously submitted but not funded should be identified as being “revised” even if the original Principal Investigator has changed.
  - b. Indicate the status of IRB/IACUC for your proposal. If IRB or IACUC review is unavoidably delayed beyond the submission of the application, enter “Pending” on the Proposal Cover Page, and be advised that the certification must be received within 90 days after the due date for which the application is submitted.



- c. Provide your TIN and CAGE numbers. Every U.S. institution that submits a proposal to a U.S. agency must provide their permanently-assigned Taxpayer Identification Number (TIN) and must register with the Department of Defense Central Contractor Registration (CCR) database for a permanently-assigned Commercial and Government Entity (CAGE) number. Reference the 2003 NRA Proposers Guidebook (<http://www.hq.nasa.gov/office/procurement/nraguidebook>) for additional information.

Click on “Continue.”

- 7) The Team Member Page screen will appear, where you can add or remove team members. Select “Continue” if there are no other team members. To add a team member, highlight the role option on the selection list, type in first and last name and click on search. When the resulting set appears, choose the appropriate radio button and click on ADD to add the person to the proposal. After you are done, click on “Continue.”

**You must include your authorizing official as a team member.** When you complete and print the proposal cover page, you will see signature blocks both for yourself and your authorizing official. You are required to submit one original signed (by both you and your authorizing official) cover page with your proposal hardcopies.

**IMPORTANT:** If the team member is not listed in our database, please have them add themselves as a new user to the system. You may then add them to your team member list.

- 8) After continuing from the Team Member Page, the Proposal Options Page appears.
- 9) Please fill out the budget form by clicking on the “Budget” button, filling in project costs, and clicking “Continue.” This will bring you to the Proposal Budget Review Page. Click “Continue” if the information is correct.
- 10) After verifying your budget information, you will be returned to the Proposal Options Page. Click the “Show/Print” button.
- 11) For detailed budget information, you may use your own forms or download template forms located at [http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-02/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-02/index.html). These forms cannot be electronically submitted. Fill out the forms and attach them to your proposal.
- 12) At the page entitled Proposal Information Item List, click “Continue” to preview your Proposal Cover Page. Print the cover page from your Internet browser once you have reviewed the information. The cover page must be signed by both the Principal Investigator and the authorizing official and attached to the front of your proposal before submission of hard copies to NASA.

By signing and submitting the proposal identified on the cover sheet, the Authorizing Official of the proposing institution (or the individual investigator if there is no proposing institution): 1) certifies that the statements made in the proposal are true and complete to the best of his/her knowledge; 2) agrees to accept the obligations to comply with NASA Award terms and conditions if an award is made as a result of this proposal; 3) provides certification to the following that are reproduced in their entirety in Appendix D of this NRA: (i) Certification Regarding Debarment, Suspension and Other Responsibility matters, (ii) Certification Regarding Lobbying, and (iii) Certification of Compliance with the NASA Regulations Pursuant to Nondiscrimination in Federally Assisted Programs.

- 13) You may edit and resubmit your proposal cover page at any time before the submission deadline as indicated in the Summary and Supplemental Information Section of this NRA. Please note that once you submit a proposal cover page, it can only be edited, not deleted. For title, team member, budget or any other changes, please edit your existing proposal cover page and resubmit changes to avoid duplicate records.

#### D. Instructions for Preparation and Delivery of Proposals

**All** proposals submitted must include the completed cover page form as described in this Appendix. The name of the Principal Investigator should appear in the upper right hand corner of each page of the proposal, except on the cover page form, where special places are provided for this information. Note that the proposal must specify the period of performance for the work described; periods of performance may be for any duration up to the maximum duration identified in the Announcement section of this NRA but should be suitable for the project proposed.

**The proposal must include the following material, in this order:**

- (1) Proposal Cover Page: Solicited Proposal Application, including certification of compliance with U.S. code (if applicable). One signed original required. Please see “Instructions for Preparing and Electronically Submitting a Proposal Cover Page” (Appendix B, Section I, Part C) for instructions on how to complete the proposal cover page information.
- (2) Transmittal Letter or Prefatory Material, if any (see “Instructions for Responding to NASA Research Announcements” for details)
- (3) Proposal Title Page, with Notice of Restriction on Use and Disclosure of Proposal Information, if any (see “Instructions for Responding to NASA Research Announcements,” for details)

#### (4) Project Description

The length of the Project Description section of the proposal cannot exceed 40 pages using regular (12 point) type. Text must be printed on one side only and should have the following margins: left = 1.5”; Right, top, bottom = 1.0”..... Referenced figures must be included in the 40 pages of the Project Description. The Bibliography, Management Approach, and all following sections are not considered part of the 40-page project description. Proposals that exceed the 40-page limit for the project description will not be reviewed. The proposal should contain sufficient detail to enable reviewers to make informed judgments about the overall merit of the proposed research and about the probability that the investigators will be able to accomplish their stated objectives with current resources and the resources requested. In addition, the proposal should clearly indicate the relationship between the proposed work and the research emphases defined in this Announcement. Reviewers are not required to consider information presented as appendices or to view and/or consider Web links in their evaluation of the proposal.

#### (5) Management Approach

Each proposal must specify a single Principal Investigator (Director) who is responsible for carrying out the proposed project and coordinating the work of other personnel involved in the project. The roles and responsibilities of the Associate Directors, Research Leads and other Key Personnel in the NSCOR and the proportion of each individual's time to be devoted to the proposed research activity must be clearly defined. The proposal must clearly and unambiguously state whether these key personnel have reviewed the proposal and endorsed their participation.

Investigators are strongly encouraged to identify only the most critically important personnel to aid in the execution of their proposals. Should such positions be necessary, Co-Investigators (co-Is) may be identified who are critical for the successful completion of research through the contribution of unique expertise and/or capabilities, and who serve under the direction of the PI, regardless of whether or not they receive compensation under the award. Most NRAs require a co-I to have a well-defined role in the research that is defined in the Management section of the proposal. Evidence of a co-I's commitment to participate is often requested through a brief letter to be included with the proposal.

There are three subcategories of co-Is that a proposal may identify, as appropriate:

- A co-I may be designated as the Science PI for those cases where the proposing institution does not permit that individual to formally serve as the PI as defined above. In such a case, the Science PI will be understood by NASA to be in charge of the scientific direction of the proposed work, although the formally designated PI is still held responsible for the overall direction of the effort and use of funds.

- A co-I may be designated as an *Institutional PI* when their institution is making a major contribution to a proposal submitted by a PI from another institution.
- A co-I from a non-U.S. institution may be designated as a *co-Principal Investigator* (co-PI) should such a designation serve required administrative purposes in that co-I's institution and/or for the procurement of funding by that co-I from their sponsoring funding authority.

Additional category positions are often included in proposals as defined as follows:

A *Postdoctoral Associate* holds a Ph.D. or equivalent degree and is identified as a major participant in the execution of the proposed research. Such personnel may be identified by name or only by function in those cases where their recruitment depends on the successful selection of the proposal.

*Other Professional* is a description appropriate for personnel who support a proposal in a critical albeit intermittent manner, such as a consulting staff scientist or a key Project Engineer and/or Manager, who is not identified as a co-I or Postdoctoral Associate.

A *Graduate Student* included in a proposal is working for a post-graduate degree and will support the proposed research under direction of the PI. Such a student may be identified by name or only by function in case their recruitment depends on the successful selection of the proposal.

A *Collaborator* is an unfunded position included in a proposal, whose participation is less critical than a co-I, but who is committed to provide a specific contribution to the proposal

#### (6) Personnel/Biographical Sketches

The NSCOR Director is responsible for direct supervision of the work and must participate in the conduct of the research regardless of whether or not compensation is received under the award. A short biographical sketch of the Director that includes his or her current position title and educational background, a list of principal publications, and a description of any exceptional qualifications must be included. The research and professional experience of the Associate Director, Research Leads and other Key Personnel must be described. Concluding with present position, chronologically list previous employment, experience, and honors. Include present membership on any Federal Government public advisory committee. List, in chronological order, the titles, all authors, and complete references to all publications during the past three years and to representative earlier publications pertinent to this application. If the list of publications in the last three years exceeds two pages, select the most pertinent publications (see "Appendix D: Instructions for Responding to NASA Research Announcements" for details). A sample biographical sketch form can be downloaded at [http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-02/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-02/index.html). These forms cannot be electronically submitted.. Do not exceed two pages.

Omit social security numbers and other personal items that do not merit consideration in evaluation of the proposal. Provide similar biographical information on other senior professional personnel who will be directly associated with the project. Provide the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described. Fill out the forms and attach them to your proposal

#### (7) Facilities and Equipment

Describe the available facilities and major items of equipment specially adapted or suited to the proposed research activities, and any additional major equipment that will be required. Identify any government-owned facilities, industrial plant equipment, or special tooling that are proposed for use in the research activities. The research plan must provide evidence that such facilities or equipment will be made available if the proposal is accepted. Before requesting a major item of capital equipment, the proposer should determine the availability of equipment already within the organization as an alternative to purchase. Where such arrangements cannot be made, the proposal should state this explicitly. The need for items that can be typically used for research and non-research purposes should be explained.

#### (8) Special Matters (specific information on animal or human subjects protocol approval required, if applicable)

For proposals employing human subjects and/or animals, assurance of compliance with human subjects and/or animal care and use provisions is required on the Proposal Cover Page. In addition, the application must include a statement from the applicant institution certifying that the proposed work will meet all Federal and local human subjects requirements and/or animal care and use requirements.

Policies for the protection of human subjects in NASA sponsored research projects are described in NASA Management Instruction (NMI) 7100.8B (*Protection of Human Research Subjects*). Animal use and care requirements are described in the NASA Code of Federal Regulations (CFR) 1232 (*Care and Use of Animals in the Conduct of NASA Activities*). Both documents are available from the Office of Biological and Physical Research, Code UB, NASA Headquarters, Washington, DC 20546.

#### Additional Requirements for Research Employing Human Subjects

A letter signed by the Chair of the Institutional Review Board (IRB) identifying the proposal submitted to NASA by title and certifying approval of proposed human subjects protocols and procedures should be included with each copy of the proposal. IRB certifications for other research proposals or grants cannot be substituted (even if they employ the same protocols and procedures).

If IRB certification is pending on the proposal due date, select “pending” from the IRB/IACUC section menu on the Proposal Cover Page, and include with each copy of the proposal a letter signed by the IRB Chair identifying the proposal by title and indicating the status of the IRB review process at the time of submission. IRB certification must be received no later than 90 days after the proposal due date. An application lacking the required IRB certification 90 days after the proposal due date will be considered incomplete and may be returned to the applicant without review.

With regard to research involving human subjects, NASA and the NSBRI have adopted the National Institutes of Health (NIH) policy. Women and members of minority groups and their subpopulations must be included in NASA-supported biomedical and behavioral research projects involving human subjects, unless a clear and compelling rationale and justification is provided showing that inclusion of these groups is inappropriate with respect to the health of the subjects or the purpose of the research.

NASA will require current IRB certification prior to each year’s award.

#### Additional Requirements for Research Employing Animals

**Specific information describing and justifying the use of animal subjects must be included in the proposal.**

A letter signed by the Chair of the Institutional Animal Care and Use Committee (IACUC) identifying the proposal submitted to NASA by title and certifying approval of the proposed animal research protocols and procedures should be included with each copy of the proposal. The institution’s Public Health Service Animal Welfare Assurance Number must be included on the IACUC certification and entered in the IRB/IACUC section of the Proposal Cover Page. IACUC certifications for other research proposals or grants cannot be substituted (even if they employ the same protocols and procedures).

If IACUC certification is pending on the proposal due date, select “pending” from the IRB/IACUC selection menu on the Proposal Cover Page, and include with each copy of the proposal a letter signed by the IACUC Chair identifying the proposal by title and indicating the status of the IACUC review process at the time of submission. IACUC certification must be received no later than 90 days after the proposal due date. An application lacking the required IACUC certification 90 days after the proposal due date will be considered incomplete and may be returned to the applicant without review.

NASA will require current IACUC certification prior to each year’s award.

## (9) Detailed Budget and Supporting Budgetary Information

For detailed budget information, you may use your own forms or download template forms located at [http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-02/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-02/index.html). These forms cannot be electronically submitted. Fill out the forms and attach them to your proposal.

NASA is expected to be operating on the basis of full cost accounting as soon as possible, including all Civil Service salaries with overhead. In the interim period, proposals should use the accounting method authorized at their institutions at the time proposals are due and for the entire proposed period of performance. Funds to support the Resident Research Assistant (RRA) Postdoctoral Program costs (e.g., stipend, travel, computer time, supplies, etc.) are to be budgeted within the NASA intramural Principal Investigator budget.

If travel is planned, the proposal budget should include appropriate travel funds for visits to NASA field centers (as appropriate) and presentation of findings at professional society meetings.

In this solicitation, the terms “cost” and “budget” are used synonymously. Sufficient proposal cost detail and supporting information are required; funding amounts proposed with no explanation (e.g., Equipment: \$1,000, or Labor: \$6,000) may cause delays in evaluation and award. Generally, costs will be evaluated for realism, reasonableness, allowability, and allocation. The budgetary forms define the desired detail, but each category should be explained. Offerors should exercise prudent judgment in determining what to include in the proposal, as the amount of detail necessarily varies with the complexity of the proposal.

The following examples indicate the suggested method of preparing a cost breakdown:

### Direct Labor

Labor costs should be segregated by titles or disciplines with estimated hours and rates for each. Estimates should include a basis of estimate, such as currently paid rates or outstanding offers to prospective employees. This format allows the Government to assess cost reasonableness by various means including comparison to similar skills at other organizations.

### Other Direct Costs

Please detail, explain, and substantiate other significant cost categories as described below:

- Subcontracts: Describe the work to be contracted, estimated amount, recipient (if known), and the reason for subcontracting.

- Consultants: Identify consultants to be used, why they are necessary, the time they will spend on the project, and the rates of pay.
- Equipment: List separately. Explain the need for items costing more than \$5,000. Describe basis for estimated cost. General-purpose equipment is not allowable as a direct cost unless specifically approved by the NASA Grant Officer. Any equipment purchase requested as a direct charge must include the equipment description, how it will be used in the conduct of the basic research proposed, and why it cannot be purchased with indirect funds.
- Supplies: Provide general categories of needed supplies, the method of acquisition, and estimated cost.
- Travel: Describe the purpose of the proposed travel in relation to the grant, and provide the basis of estimate, including information on destination and number of travelers (if known).
- Other: Enter the total of direct costs not covered by a) through e). Attach an itemized list explaining the need for each item and the basis for the estimate.

#### Indirect Costs

Indirect costs should be explained to an extent that will allow the Government to understand the basis for the estimate. Examples of prior year historical rates, current variances from those rates, or an explanation of other basis of estimates should be included. Where costs are based on allocation percentages or dollar rates, an explanation of rate and application base relationships should be given. For example, the base to which the General and Administrative (G&A) rate is applied could be explained as: application base equals total costs before G&A less subcontracts.

All awards made as a result of this NRA will be funded as grants. Proposals submitted by "for profit" organizations are allowed, however, they cannot include a "fee."

(10) Appendices, if any (**reviewers are not required to consider information presented in appendices**)

(11) One (1) signed original and twenty (20) copies of the proposal cover page and the proposals must be received by **4:30 p.m., June 2, 2003**, at the following address:

NASA Peer Review Services  
 SUBJECT: 03-OBPR-02 Space Radiation Research NSCOR  
 500 E Street SW  
 Suite 200  
 Washington, DC 20024  
 (202) 479-9030



## II. Proposal Evaluation and Awards Selection Process

The following information is specific to this NRA and **supersedes** the information contained in paragraphs (i) and (j) of “Appendix D: Instructions for Responding to NASA Research Announcements.”

### A. Compliance Matrix

All proposals must comply with the general requirements of the Announcement as described in both Appendices B and “Instructions for Responding to NASA Research Announcements.” Appendix B contains specific requirements and explanations for each section of the proposal above and beyond NASA-specified requirements. “Instructions for Responding to NASA Research Announcements” outlines the NASA-specified requirements for proposal submission and should be used for clarification and reference. Upon receipt, proposals will be reviewed for compliance with the requirements of this Announcement. This includes

1. Submission of complete proposals specified in this Announcement. Proposals must be responsive to the areas of program element emphasis described in this Announcement and include a project description that is not more than 40 pages in length.
2. Submission of appropriate Institutional Review Board (IRB) or Animal Care and Use Committee (ACUC) certification for all proposals using human or animal test subjects.
3. Submission of a budget that is within the guidelines specified in this Announcement and is for a funding period not exceeding that described in the Announcement.
4. Submission of all other appropriate information as required by this NASA Research Announcement (refer to Section I, Appendix B).

***Note: At NASA’s discretion, non-compliant proposals may be withdrawn from the review process and returned to the investigator without further review.***

Compliant proposals submitted in response to this Announcement will undergo an intrinsic scientific or technical merit review. Only those proposals most highly rated in the merit review process will undergo additional reviews for program relevance and cost.

### B. Intrinsic Scientific or Technical Merit Review and Evaluation Criteria

The overall evaluation process for proposals submitted in response to this Announcement will include the following reviews:

#### **First Review Tier**

**Merit Review:** A review for intrinsic technical or scientific merit and overall impact will be conducted for all proposals.

## Second Review Tier

**Review for Relevance and Cost:** Relevance to NASA and proposed project cost.

The **first review tier** will be a merit review by a panel of scientific or technical experts. The number and diversity of experts required will be determined by the response to this NRA and by the variety of disciplines represented in the proposals relevant to the research emphases described in Appendix A. The merit review panel will assign *a score from 0-100* based upon the intrinsic scientific or technical merit of the proposal. This score will reflect the consensus of the panel.

The score assigned by this panel *will not be affected by the cost of the proposed work nor will it reflect the programmatic relevance of the proposed work to NASA*. However, the panel will be asked to include in their critique of each proposal any comments they may have concerning the proposal's budget and relevance to NASA.

All of the following criteria, of equal value, will be used in determining the merit score:

- **Approach:** Are the proposed component projects adequately developed, well defined, well integrated, and appropriate to the aims of the NSCOR? Is the proposed approach likely to yield the desired results? Does the proposal acknowledge potential problem areas and consider alternative tactics? Is it likely that the proposed implementation timeline will be met?
- **Key Personnel and Investigators:** Do the qualifications, experience and proposed commitment of the proposed Director, Associate Director(s) and Research Leads reflect the scientific knowledge and effective leadership potential that will result in a successful NSCOR?
- **Environment:** Does the scientific environment in which the work will be performed contribute to the probability of success? Are the proposed facilities and equipment to be used adequate to achieve the goals of the NSCOR? Is there evidence of institutional support?
- **Collaboration and Overall Impact:** Will the proposed NSCOR foster effective collaborations between the investigators within the NSCOR? Are the research and knowledge transfer activities strategically integrated such that the whole is greater than the sum of the parts? Are all partners vital participants in the NSCOR effort?
- **Internal Assessment:** Does the proposed NSCOR have an adequate internal advisory group in order to ensure that it will be able to meet the goals established by NASA and adjudicate internal matters efficiently?

### C. Evaluation of Programmatic Relevance and Cost

The **second review** will evaluate the programmatic relevance and cost of all proposed work. This review will be conducted by NASA Program Scientists and Managers. Evaluation of the cost of a proposed effort includes consideration of the realism and reasonableness of the proposed cost and the relationship of the proposed cost to available funds.

Programmatic relevance will include an evaluation of the extent to which the proposal covers the areas of interest within each NSCOR and the extent to which the combined effort is likely to exceed the contribution expected from the collection of individual projects. Proposers are not required to cover the entire discipline area solicited in each NSCOR, but only that part of the solicited research that best matches the NSCOR criteria with the investigators' expertise. The degree of integration, i.e., the extent to which the whole is likely to be greater than the sum of the parts, will be emphasized by NASA reviewers more than breadth of coverage. However, proposals are expected to cover a scientifically significant area of the solicited area of research and to avoid a narrow focus.

#### D. Development of Selection Recommendation

The most important element in the evaluation process is the merit review, which carries the highest weight in final evaluation and selection. The other factors are approximately equal in weight to each other.

The information resulting from these two levels of review, as described above, will be used to prepare a **selection recommendation** developed by NASA program scientists and managers for each of the program elements described in this Announcement. This recommendation will be based on:

1. The scientific or technical merit review score from the peer review panel.
2. The programmatic relevance.
3. The cost of each proposal.

This **selection recommendation** is the responsibility of the NASA program scientist(s). Selection for funding will be made by the selecting official identified in the Summary and Supplemental Information Section of this NRA. There will be one selection for each of the three focused NSCOR areas described as NSCORs 1, 2, and 3 in Appendix A, Section IV.

At the end of the selection process, each proposing organization is notified of its selection or nonselection status. NASA provides debriefings to those investigators who request one. The selection letters will include a statement indicating the selected organization's business office will be contacted by a NASA Contracting or Grant Officer, who is the only official authorized to obligate the Government, and a reminder that any costs incurred by the investigator in anticipation of an award are at their own risk. Selection notification will be made by a letter signed by the selecting official.

The NASA Procurement Office will determine the type of award instrument, request further business data, negotiate the resultant action, and are the only personnel with the authority to obligate government funds.

NASA reserves the right to offer selection of only a portion of a proposal. In these instances, the investigator will be given the opportunity to accept or decline the offer.

### **III. Guidelines for International Participation**

Guidelines for International Participation are detailed in paragraph 1 of Appendix D of this Announcement.

**Export Control Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.** Foreign proposals and proposals including foreign participation must include a section discussing compliance with U.S. export laws and regulations, e.g., 22 CFR Parts 120-130 and 15 CFR Parts 730-774, as applicable to the circumstances surrounding the particular foreign participation. The discussion must describe in detail the proposed foreign participation and is to include, but not be limited to, whether or not the foreign participation may require the prospective investigator to obtain the prior approval of the Department of State or the Department of Commerce via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available at <http://www.pmdtc.org/> and <http://www.bxa.doc.gov/>. Investigators are advised that under U.S. law and regulations, spacecraft and their specifically designed, modified, or configured systems, components, and parts are generally considered “Defense Articles” on the United States Munitions List and are subject to the provisions of the International Traffic in Arms Regulations (ITAR), 22 CFR Parts 120-130.

### **IV. Support of Education and Public Outreach**

OBPR envisions that the selected proposals will be structured and operated in a manner that supports the nation’s educational initiatives and goals (including support of historically black colleges and universities and other minority universities), and in particular the need to promote scientific and technical education at all levels. OBPR envisions that the selected proposals will support the goals for public awareness and outreach to the general public (see Announcement Section). The selected principal investigators are invited to participate in OBPR-funded educational programs.

#### **OBPR Policy for Education (Grades 6-12) and Public Outreach**

The proposal represents an opportunity for NASA to enhance and broaden the public’s understanding and appreciation of the value of OBPR research in the context of NASA’s mission. Therefore, all investigators are strongly encouraged to promote general scientific literacy and public understanding of OBPR research through formal and/or informal education opportunities. If appropriate, proposals should include a clear and concise description of the education and outreach activities proposed. Examples include such items as involvement of students in the research activities, technology transfer plans, public information programs that

will inform the general public of the benefits being gained from the research, and/or plans for incorporation of scientific results obtained into educational curricula consistent with educational standards.

Where appropriate, the supported institution will be required to produce, in collaboration with NASA, a plan for communicating to the public the value and importance of their work. Once NRA selections are made, the selected PIs will have an opportunity to request additional funding through an OBPR-sponsored pilot program to implement an education outreach program at the grades 6-12 level, at an amount not to exceed \$10,000 per year for the term of the grant. A request for proposal will accompany the selection notification letter. Proposals will be due within 60 days of selection notification and shall be limited to 4 pages. A review of these proposals by educational specialists will determine which proposals will be funded.

## V. References

### A. General References

**Guidebook for Proposers Responding to a NASA Research Announcement (NRA).** This document is available online at the following address:

**<http://www.hq.nasa.gov/office/procurement/nraguidebook>**

**OBPR Program Tasks and Bibliography (Task Book) for FY 1995 through FY 2002** are available online at the following address: **<http://research.hq.nasa.gov/taskbook.cfm>**

**Space Life Sciences Ground Facilities Information Package.** This document is available online at the following address:

**[http://research.hq.nasa.gov/code\\_u/nra/current/NRA-03-OBPR-02/index.html](http://research.hq.nasa.gov/code_u/nra/current/NRA-03-OBPR-02/index.html)**

Life sciences research publications: **<http://spaceline.usuhs.mil>**, and **<http://www.nlm.nih.gov>**. Additional information may be obtained from the SPACELINE Project (phone: (301) 295-2482; e-mail: [spaceline@usuhs.mil](mailto:spaceline@usuhs.mil))

National Academy of Science. National Research Council Committee on Space Biology and Medicine. Mary J. Osborn, Committee Chairperson. **A Strategy for Research in Space Biology and Medicine in the New Century.** 1998. Washington D.C: National Academy Press. Web address: **<http://www.nas.edu/ssb/csbm1.html>**

A. Nicogossian, C. Huntoon, and S. Pool. (Eds.) **Space Physiology and Medicine**, 3rd ed. Lea & Febiger. Philadelphia, PA (1994).

*FASEB Journal*, Vol. 13, Supplement, **Cell & Molecular Biology Research in Space.** (1999). *Brain Research Reviews*, **Space Neuroscience Research.** Volume 28, Numbers 1/2, Special Issue, (1998).

NASA Space Radiation Health Program:

[http://spaceresearch.nasa.gov/common/docs/radiation\\_strat\\_plan\\_1998.pdf](http://spaceresearch.nasa.gov/common/docs/radiation_strat_plan_1998.pdf)

Space Radiation Health Project at Johnson Space Center: <http://srhp.jsc.nasa.gov/>

## B. Selected Radiation References

Alpen, E.L., Powers-Risius, P., Curtis, S.B., and DeGuzman, R. Tumorigenic potential of high-Z, high-LET charged particle irradiations. *Radiat. Res.* 88, 132-143 (1993).

Blakely, E.A., Bjornstad, K.A., Chang, P.Y., McNamara, M.P., Chang, E., Aragon, G., Lin, S.P., Lui, G., and Polansky, J.R. Growth and differentiation of human lens epithelial cells in vitro on matrix. *Inv. Opth. & Vis. Sci.* 41, 3898-3907 (1999).

Cucinotta, F. A., W. Schimmerling, J. W. Wilson, L. E. Peterson, G. Badhwar, P. Saganti, and J. Dicello. Space Radiation Cancer Risks and Uncertainties for Mars Missions. *Radiat. Res.* 156: (2001)156, 682–688.

Cucinotta, F. A., F.K. Manuel, J. Jones, G. Iszard, J. Murrey, B. Djojonegro, and M. Wear. Space Radiation and Cataracts in Astronauts. *Radiat. Res.* 156: 460-466 (2001).

Cucinotta, F.A., Nikjoo, H., and Goodhead, D.T. The effects of delta rays on the number of particle-track traversals per cell in laboratory and space exposures. *Radiat. Res.* 150, 115-119 (1998).

Cucinotta, F.A., Wilson, J.W., Williams, J.R., and Dicello, J.F. Analysis of Mir-18 results for physical and biological dosimetry: radiation shielding effectiveness in *LEO*. *Radiat. Meas.* **31**, 181-191 (2000).

Ernhart, E.J., E.L. Gillette, E.L., and Barcellos-Hoff, M.H. Immunohistochemical evidence for rapid extracellular matrix remodeling after iron-particle irradiation of mouse mammary gland. *Radiat. Res.* 145, 157-162 (1996).

Fry R.J.M., Powers-Risius P., Alpen E.L., Ainsworth, E.J. High LET radiation carcinogenesis. *Radiat. Res.* 104, S188-195 (1985).

Goodhead, D.T. Initial events in the cellular effects of ionizing radiations: clustered damage in DNA. *Int. J. Radiat. Biol.* **65**, 7-17 (1994).

Joseph, J.A., Hunt, W.A., Rabin, B.M., Dalton, T.K. Possible accelerated aging induced by <sup>56</sup>Fe heavy particle irradiation: Implications for manned space flights. *Radiat. Res.* 130, 88-93 (1992).

National Council on Radiation Protection and Measurements (NCRP). Guidance on Radiation Received in Space Activities. Report 98. Washington, DC (1989)

National Council on Radiation Protection and Measurements (NCRP). Uncertainties in Fatal

Cancer risk Estimates Used in Radiation Protection. Report 126. Washington, DC (2000)

National Council on Radiation Protection and Measurements (NCRP). Radiation Protection Guidance for Activities in Low-Earth Orbit. Report 132. Washington, DC (2000).

National Research Council. Radiation Hazards to Crews of Interplanetary Missions: Biological Issues and Research Strategies. National Academy Press, Washington, DC (1996)

National Research Council. Radiation and the International Space Station. National Academy Press, Washington, DC (2000).

Schimmerling, W. Space and radiation protection: scientific requirements for space research. Radiat. Environ. Biophys. 34: 133-137 (1995).

Zeitlin, C., J. Miller, L. Heilbronn, K. Frankel, W. Gong and W. Schimmerling, The Fragmentation of 510 MeV/Nucleon Iron-56 in Polyethylene. I. Fragment Fluence Spectra. Radiat. Res. 145: 655-665 (1996).

Zeitlin, C., L. Heilbronn, J. Miller W. Schimmerling, L. W. Townsend, R.K. Tripathi, and J. Wilson The Fragmentation of 510 MeV/Nucleon Iron-56 in Polyethylene. II. Comparisons between Data and a Model. Radiat. Res. 145: 666-672 (1996).

### C. Selected Workshop Reports

**Modeling Human Risk: Cell & Molecular Biology in Context.** June, 1997. Ernest Orlando Lawrence Berkeley National Laboratory Report LBNL-40278. Berkeley, CA

**International Space Life Sciences Working Group on Radiation Biology.** Banff, Canada, November 1997. Mutation Res., 430: No. 2 (1999)

**Models for Evaluation of Radiation Risk Factors.** Radiat. Res. 156: Number 5, Part 2. November, 2001.

Second International Workshop on Space Radiation Research and 13th Annual NASA Space Radiation Health Investigators' Workshop, March 10-15, 2002, Nara, Japan:  
<http://www.nirs.go.jp/usr/workshop/index.htm>

### D. Selected Radiation Web Sites

NASA activities at Brookhaven National Laboratory:  
<http://www.bnl.gov/medical/NASA/NASA-home%20frame.htm>

NASA Specialized Center of Research and Training at Lawrence Berkeley Laboratory:  
<http://www.lbl.gov/lifesciences/NSCORT/>

**CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER  
RESPONSIBILITY MATTERS**

*PRIMARY COVERED TRANSACTIONS*

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This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 14 CFR Part 1269.

A. The applicant certifies that it and its principals:

- (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;
- (b) Have not within a three-year period preceding this application been convicted or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or Local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
- (c) Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or Local) with commission of any of the offenses enumerated in paragraph A.(b) of this certification; and
- (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or Local) terminated for cause or default; and

B. Where the applicant is unable to certify to any of the statements in this certification, he or she shall attach an explanation to this application.

C. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lowered Tier Covered Transactions (Subgrants or Subcontracts)

- a) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principles is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any federal department of agency.
- b) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.



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## **CERTIFICATION REGARDING LOBBYING**

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As required by S 1352 Title 31 of the U.S. Code for persons entering into a grant or cooperative agreement over \$100,000, the applicant certifies that:

- (a) No Federal appropriated funds have been paid or will be paid by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, in connection with making of any Federal grant, the entering into of any cooperative, and the extension, continuation, renewal, amendment, or modification of any Federal grant or cooperative agreement;
- (b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting an officer or employee of any agency, Member of Congress, an or an employee of a Member of Congress in connection with this Federal grant or cooperative agreement, the undersigned shall complete Standard Form - LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (c) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subgrants, contracts under grants and cooperative agreements, and subcontracts), and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by S1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

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**CERTIFICATION OF COMPLIANCE WITH THE NASA REGULATIONS PURSUANT  
TO  
NONDISCRIMINATION IN FEDERALLY ASSISTED PROGRAMS**

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The (Institution, corporation, firm, or other organization on whose behalf this assurance is signed, hereinafter called "Applicant") hereby agrees that it will comply with Title VI of the Civil Rights Act of 1964 (P.L. 88-352), Title IX of the Education Amendments of 1962 (20 U.S. 1680 et seq.), Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S. 794), and the Age Discrimination Act of 1975 (42 U.S. 16101 et seq.), and all requirements imposed by or pursuant to the Regulation of the National Aeronautics and Space Administration (14 CFR Part 1250) (hereinafter called "NASA") issued pursuant to these laws, to the end that in accordance with these laws and regulations, no person in the United States shall, on the basis of race, color, national origin, sex, handicapped condition, or age be excluded from participating in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity for which the Applicant receives federal financial assistance from NASA; and hereby give assurance that it will immediately take any measure necessary to effectuate this agreement.

If any real property or structure thereon is provided or improved with the aid of federal financial assistance extended to the Applicant by NASA, this assurance shall obligate the Applicant, or in the case of any transfer of such property, any transferee, for the period during which the real property or structure is used for a purpose for which the federal financial assistance is extended or for another purpose involving the provision of similar services or benefits. If any personal property is so provided, this assurance shall obligate the Applicant for the period during which the federal financial assistance is extended to it by NASA.

This assurance is given in consideration of and for the purpose of obtaining any and all federal grants, loans, contracts, property, discounts, or other federal financial assistance extended after the date hereof to the Applicant by NASA, including installment payments after such date on account of applications for federal financial assistance which were approved before such date. The Applicant recognized and agrees that such federal financial assistance will be extended in reliance on the representations and agreements made in this assurance, and the United States shall have the right to seek judicial enforcement of this assurance. His assurance is binding on the Applicant, its successors, transferees, and assignees, and the person or persons whose signatures appear below are authorized to sign on behalf of the Applicant.

## **INSTRUCTIONS FOR RESPONDING TO NASA RESEARCH ANNOUNCEMENTS**

**(MAY 2002)**

**(a) General.**

(1) Proposals received in response to a NASA Research Announcement (NRA) will be used only for evaluation purposes. NASA does not allow a proposal, the contents of which are not available without restriction from another source, or any unique ideas submitted in response to an NRA to be used as the basis of a solicitation or in negotiation with other organizations, nor is a pre-award synopsis published for individual proposals.

(2) A solicited proposal that results in a NASA award becomes part of the record of that transaction and may be available to the public on specific request; however, information or material that NASA and the awardee mutually agree to be of a privileged nature will be held in confidence to the extent permitted by law, including the Freedom of Information Act.

(3) NRAs contain programmatic information and certain requirements which apply only to proposals prepared in response to that particular announcement. These instructions contain the general proposal preparation information which applies to responses to all NRAs.

(4) A contract, grant, cooperative agreement, or other agreement may be used to accomplish an effort funded in response to an NRA. NASA will determine the appropriate award instrument. Contracts resulting from NRAs are subject to the Federal Acquisition Regulation and the NASA FAR Supplement. Any resultant grants or cooperative agreements will be awarded and administered in accordance with the NASA Grant and Cooperative Agreement Handbook (NPG 5800.1).

(5) NASA does not have mandatory forms or formats for responses to NRAs; however, it is requested that proposals conform to the guidelines in these instructions. NASA may accept proposals without discussion; hence, proposals should initially be as complete as possible and be submitted on the proposers' most favorable terms.

(6) To be considered for award, a submission must, at a minimum, present a specific project within the areas delineated by the NRA; contain sufficient technical and cost information to permit a meaningful evaluation; be signed by an official authorized to legally bind the submitting organization; not merely offer to perform standard services or to just provide computer facilities or services; and not significantly duplicate a more specific current or pending NASA solicitation.

**(b) NRA-Specific Items.** Several proposal submission items appear in the NRA itself: the unique NRA identifier; when to submit proposals; where to send proposals; number of copies required; and sources for more information. Items included in these instructions may be supplemented by the NRA.

(c) The following information is needed to permit consideration in an objective manner. NRAs will generally specify topics for which additional information or greater detail is desirable. Each proposal copy shall contain all submitted material, including a copy of the transmittal letter if it contains substantive information.

**(1) Transmittal Letter or Prefatory Material.**

(i) The legal name and address of the organization and specific division or campus identification if part of a larger organization;

(ii) A brief, scientifically valid project title intelligible to a scientifically literate reader and suitable for use in the public press;

(iii) Type of organization: e.g., profit, nonprofit, educational, small business, minority, women-owned, etc.;

(iv) Name and telephone number of the principal investigator and business personnel who may be contacted during evaluation or negotiation;

(v) Identification of other organizations that are currently evaluating a proposal for the same efforts;

(vi) Identification of the NRA, by number and title, to which the proposal is responding;

(vii) Dollar amount requested, desired starting date, and duration of project;

(viii) Date of submission; and

(ix) Signature of a responsible official or authorized representative of the organization, or any other person authorized to legally bind the organization (unless the signature appears on the proposal itself).

**(2) Restriction on Use and Disclosure of Proposal Information.** Information contained in proposals is used for evaluation purposes only. Offerors or quoters should, in order to maximize protection of trade secrets or other information that is confidential or privileged, place the following notice on the title page of the proposal and specify the information subject to the notice by inserting an appropriate identification in the notice. In any event, information contained in proposals will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

## Notice

### Restriction on Use and Disclosure of Proposal Information

The information (data) contained in [insert page numbers or other identification] of this proposal constitutes a trade secret and/or information that is commercial or financial and confidential or privileged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed other than for evaluation purposes; provided, however, that in the event a contract (or other agreement) is awarded on the basis of this proposal the Government shall have the right to use and disclose this information (data) to the extent provided in the contract (or other agreement). This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

(3) **Abstract.** Include a concise (200-300 word if not otherwise specified in the NRA) abstract describing the objective and the method of approach.

**(4) Project Description.**

(i) The main body of the proposal shall be a detailed statement of the work to be undertaken and should include objectives and expected significance; relation to the present state of knowledge; and relation to previous work done on the project and to related work in progress elsewhere. The statement should outline the plan of work, including the broad design of experiments to be undertaken and a description of experimental methods and procedures. The project description should address the evaluation factors in these instructions and any specific factors in the NRA. Any substantial collaboration with individuals not referred to in the budget or use of consultants should be described. Subcontracting significant portions of a research project is discouraged.

(ii) When it is expected that the effort will require more than one year, the proposal should cover the complete project to the extent that it can be reasonably anticipated. Principal emphasis should be on the first year of work, and the description should distinguish clearly between the first year's work and work planned for subsequent years.

(5) **Management Approach.** For large or complex efforts involving interactions among numerous individuals or other organizations, plans for distribution of responsibilities and arrangements for ensuring a coordinated effort should be described.

(6) **Personnel.** The principal investigator is responsible for supervision of the work and participates in the conduct of the research regardless of whether or not compensated under the award. A short biographical sketch of the principal investigator, a list of principal publications and any exceptional qualifications should be included. Omit social security number and other personal items which do not merit consideration in evaluation of the proposal. Give similar biographical information on other senior professional personnel who will be directly associated with the project. Give the names and titles of any other scientists and technical personnel associated substantially with the project in an advisory capacity. Universities should list the approximate number of students or other assistants, together with information as to their level of academic attainment. Any special industry-university cooperative arrangements should be described.

## **(7) Facilities and Equipment.**

(i) Describe available facilities and major items of equipment especially adapted or suited to the proposed project, and any additional major equipment that will be required. Identify any Government-owned facilities, industrial plant equipment, or special tooling that are proposed for use. Include evidence of its availability and the cognizant Government points of contact.

(ii) Before requesting a major item of capital equipment, the proposer should determine if sharing or loan of equipment already within the organization is a feasible alternative. Where such arrangements cannot be made, the proposal should so state. The need for items that typically can be used for research and non-research purposes should be explained.

## **(8) Proposed Costs (U.S. Proposals Only).**

(i) Proposals should contain cost and technical parts in one volume: do not use separate "confidential" salary pages. As applicable, include separate cost estimates for salaries and wages; fringe benefits; equipment; expendable materials and supplies; services; domestic and foreign travel; ADP expenses; publication or page charges; consultants; subcontracts; other miscellaneous identifiable direct costs; and indirect costs. List salaries and wages in appropriate organizational categories (e.g., principal investigator, other scientific and engineering professionals, graduate students, research assistants, and technicians and other non-professional personnel). Estimate all staffing data in terms of staff-months or fractions of full-time.

(ii) Explanatory notes should accompany the cost proposal to provide identification and estimated cost of major capital equipment items to be acquired; purpose and estimated number and lengths of trips planned; basis for indirect cost computation (including date of most recent negotiation and cognizant agency); and clarification of other items in the cost proposal that are not self-evident. List estimated expenses as yearly requirements by major work phases.

(iii) Allowable costs are governed by FAR Part 31 and the NASA FAR Supplement Part 1831 (and OMB Circulars A-21 for educational institutions and A-122 for nonprofit organizations).

(iv) Use of NASA funds--NASA funding may not be used for foreign research efforts at any level, whether as a collaborator or a subcontract. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted. Additionally, in accordance with the National Space Transportation Policy, use of a non-U.S. manufactured launch vehicle is permitted only on a no-exchange-of-funds basis.

**(9) Security.** Proposals should not contain security classified material. If the research requires access to or may generate security classified information, the submitter will be required to comply with Government security regulations.

**(10) Current Support.** For other current projects being conducted by the principal investigator, provide title of project, sponsoring agency, and ending date.

## **(11) Special Matters.**

(i) Include any required statements of environmental impact of the research, human subject or animal care provisions, conflict of interest, or on such other topics as may be required by the nature of the effort and current statutes, executive orders, or other current Government-wide guidelines.

(ii) Proposers should include a brief description of the organization, its facilities, and previous work experience in the field of the proposal. Identify the cognizant Government audit agency, inspection agency, and administrative contracting officer, when applicable.

**(d) Renewal Proposals.**

(1) Renewal proposals for existing awards will be considered in the same manner as proposals for new endeavors. A renewal proposal should not repeat all of the information that was in the original proposal. The renewal proposal should refer to its predecessor, update the parts that are no longer current, and indicate what elements of the research are expected to be covered during the period for which support is desired. A description of any significant findings since the most recent progress report should be included. The renewal proposal should treat, in reasonable detail, the plans for the next period, contain a cost estimate, and otherwise adhere to these instructions.

(2) NASA may renew an effort either through amendment of an existing contract or by a new award.

(e) **Length.** Unless otherwise specified in the NRA, effort should be made to keep proposals as brief as possible, concentrating on substantive material. Few proposals need exceed 15-20 pages. Necessary detailed information, such as reprints, should be included as attachments. A complete set of attachments is necessary for each copy of the proposal. As proposals are not returned, avoid use of "one-of-a-kind" attachments.

**(f) Joint Proposals.**

(1) Where multiple organizations are involved, the proposal may be submitted by only one of them. It should clearly describe the role to be played by the other organizations and indicate the legal and managerial arrangements contemplated. In other instances, simultaneous submission of related proposals from each organization might be appropriate, in which case parallel awards would be made.

(2) Where a project of a cooperative nature with NASA is contemplated, describe the contributions expected from any participating NASA investigator and agency facilities or equipment which may be required. The proposal must be confined only to that which the proposing organization can commit itself. "Joint" proposals which specify the internal arrangements NASA will actually make are not acceptable as a means of establishing an agency commitment.

(g) **Late Proposals.** Proposals or proposal modifications received after the latest date specified for receipt may be considered if a significant reduction in cost to the Government is probable or if there are significant technical advantages, as compared with proposals previously received.

(h) **Withdrawal.** Proposals may be withdrawn by the proposer at any time before award. Offerors are requested to notify NASA if the proposal is funded by another organization or of other changed circumstances which dictate termination of evaluation.

(i) **Evaluation Factors.**

(1) Unless otherwise specified in the NRA, the principal elements (of approximately equal weight) considered in evaluating a proposal are its relevance to NASA's objectives, intrinsic merit, and cost.

(2) Evaluation of a proposal's relevance to NASA's objectives includes the consideration of the potential contribution of the effort to NASA's mission.

(3) Evaluation of its intrinsic merit includes the consideration of the following factors of equal importance:

(i) Overall scientific or technical merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.

(ii) Offeror's capabilities, related experience, facilities, techniques, or unique combinations of these which are integral factors for achieving the proposal objectives.

(iii) The qualifications, capabilities, and experience of the proposed principal investigator, team leader, or key personnel critical in achieving the proposal objectives.

(iv) Overall standing among similar proposals and/or evaluation against the state-of-the-art.

(4) Evaluation of the cost of a proposed effort may include the realism and reasonableness of the proposed cost and available funds.

(j) **Evaluation Techniques.** Selection decisions will be made following peer and/or scientific review of the proposals.. Several evaluation techniques are regularly used within NASA. In all cases proposals are subject to scientific review by discipline specialists in the area of the proposal. Some proposals are reviewed entirely in-house, others are evaluated by a combination of in-house and selected external reviewers, while yet others are subject to the full external peer review technique (with due regard for conflict-of-interest and protection of proposal information), such as by mail or through assembled panels. The final decisions are made by a NASA selecting official. A proposal which is scientifically and programmatically meritorious, but not selected for award

during its initial review, may be included in subsequent reviews unless the proposer requests otherwise.

(k) **Selection for Award.**

(1) When a proposal is not selected for award, the proposer will be notified. NASA will explain generally why the proposal was not selected. Proposers desiring additional information may contact the selecting official who will arrange a debriefing.



(2) When a proposal is selected for award, negotiation and award will be handled by the procurement office in the funding installation. The proposal is used as the basis for negotiation. The contracting officer may request certain business data and may forward a model award instrument and other information pertinent to negotiation.

**(l) Additional Guidelines Applicable to Foreign Proposals and Proposals Including Foreign Participation.**

(1) NASA welcomes proposals from outside the U.S. However, foreign entities are generally not eligible for funding from NASA. Therefore, unless otherwise noted in the NRA, proposals from foreign entities should not include a cost plan unless the proposal involves collaboration with a U.S. institution, in which case a cost plan for only the participation of the U.S. entity must be included. Proposals from foreign entities and proposals from U.S. entities that include foreign participation must be endorsed by the respective government agency or funding/sponsoring institution in the country from which the foreign entity is proposing. Such endorsement should indicate that the proposal merits careful consideration by NASA, and if the proposal is selected, sufficient funds will be made available to undertake the activity as proposed.

(2) All foreign proposals must be typewritten in English and comply with all other submission requirements stated in the NRA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with paragraph (g) of this provision. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

(3) Successful and unsuccessful foreign entities will be contacted directly by the NASA sponsoring office. Copies of these letters will be sent to the foreign sponsor. Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

(4) Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

(i) An exchange of letters between NASA and the foreign sponsor; or

(ii) A formal Agency-to-Agency Memorandum of Understanding (MOU).

(m) **Cancellation of NRA.** NASA reserves the right to make no awards under this NRA and to cancel this NRA. NASA assumes no liability for canceling the NRA or for anyone's failure to receive actual notice of cancellation.